

FUNGUS SUCCESSION ON DUNG OF SOUTH AFRICAN OSTRICH AND ANGORA GOAT

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ABSTRACT

Six fungi *Arthrobotrys dactyloides* Drechsler, *Ascobolus stictioideus* Speg., *Ascodesmis sphaerospora* Obrist, *Iodophanus carneus* (Pers. per Pers.) Korf, *Sordaria humana* (Fuckel) Winter and *Chaetomium species* are recorded in South Africa for the first time. Observations have been made on the fungus succession on dung of South African ostrich and Angora goat collected during September and November, 1969, from the same locality. Variations in the fungus flora are discussed.

UITTREKSEL

SWAM SUKSESSIE OP DIE MIS VAN DIE SUID-AFRIKAANSE VOLSTRUIS EN ANGORA BOK. Ses swamme *Arthrobotrys dactyloides* Drechsler, *Ascobolus stictioideus* Speg., *Ascodesmis sphaerospora* Obrist., *Iodophanus carneus* (Pers. per Pers.) Korf, *Sordaria humana* (Fuckel) Winter en *Chaetomium species* is vir die eerste keer in Suid Afrika vermeld. Waarnemings is gedoen op die suksessie van Swamme op mis van Suid-Afrikaanse volstruis en Angora bokke versamel by dieselfde vindplek gedurende September en November, 1969. Variasies in die swamflora word bespreek.

INTRODUCTION

It is well known that succession of fungus fruit bodies on herbivore dung is a very specialised one (Hudson, 1968). There appears to be an initial phase of phycomycetes mainly Mucorales, followed by discomycetes, then pyrenomycetes and ultimately basidiomycetes. It has been suggested that the spores of these coprophilous fungi are activated to germinate after a passage through the gut of an animal. This is most certainly true for species of *Pilobolus*, *Ascobolus* and *Sporormia*.

Although this succession is well known, detailed analyses have mainly been made on dung collected in countries from the northern hemisphere. Investigations have been made on rabbit dung (Harper & Webster, 1964) and faecal pellets of millipede, *Glomeris marginata* (Villiers) (Nicholson *et al.*, 1966).

Very little appears to have been published on fungus succession on dung collected in southern Africa. Gibbs (1909) investigated four samples of dung,

Accepted for publication 12th May, 1970.

one being hippopotamus from Livingstone Island, Victoria Falls, the other three being samples from the Matoppos Hills. Gibbs recorded a complete absence of phycomycetes and there was a predominance of Sordariaceae, pyrenomycetes.

In this investigation a study was made of the colonization of dung of South African ostrich and Angora goat. This is the first time that fungi have been recorded on ostrich dung.

MATERIALS AND METHODS

South African ostrich and Angora goat were grazing in grassland enclosures at Groote Schuur Zoo, Rondebosch (CAPE—3318) and freshly deposited dung was collected on 26th September and 19th November, 1969. Ten samples of ostrich (5–10g) and ten pellets of Angora goat dung (0.3–0.6g) were each placed on sterile, moist filter paper in sterilized 14 cm Petri dishes and 10 cm crystallizing dishes respectively. The dishes were incubated at room temperature (17–21°C) in the light. The quantitative method of Harper & Webster (1964) for following fungus succession on dung was used.

NEW RECORDS

Arthrobotrys dactyloides Drechsler. Mycologia 29:447–552, 1937.

This species is recorded on nematode infested dung for the first time and frequency of the conidial structures on Angora goat dung are given in the histograms (Fig. 4). Previously it has been isolated from decaying leaves, roots of many plants and leaf mould. Drechsler (1937) describes this as “a strangling predacious fungus . . . bearing elongate uniseptate conidia in open capitate arrangement”. Vegetative mycelium and conidiophores are septate. Conidiophores bear a single cluster of 4–13 conidia. Conidia are elongate, ellipsoidal and slightly curved, being 32–48µm long and 7–9.5µm wide and there is no constriction at the septum.

Ascobolus stictoides Speg. Michelia 1:474, 1879.

Van Brummelen, 1967. *A world monograph of genera Ascobolus and Saccobolus (Ascomycetes, Pezizales)*. Leiden: Rijksherbarium.

The apothecia of this species are completely immersed in the substrata and are thus very difficult to find. The receptacle opens by irregular rupturing of the wall and asci protrude through the opening. The ascus wall stains deep blue in Melzer's reagent. The ascospores are at first hyaline but finally become dark violet in colour. Mature ascospores have the characteristic ornamentation consisting of coarse, rounded warts. Specimens were found growing on both ostrich and Angora goat dung.

Ascodesmis sphaerospora Obrist. Can. J. Bot. 39:943—953, 1961.

This species has been isolated from dung of dog, wild boar, jaguar and other carnivorous animals. These specimens were growing on ostrich dung. The genus is easily distinguished by its minute hemispherical apothecia without an excipulum. The apothecia consist of clusters of asci surrounded by paraphyses. The ascospores are spherical to ellipsoid with typical markings consisting of net-like, dark brown reticulations with ridges projecting about the periphery of the spores.

Iodophanus carneus (Pers. per Pers.) Korf apud Kimbrough & Korf. Am. J. Bot. 54:18, 1967.

This has been transferred from the genus *Ascophanus* to *Iodophanus* by Kimbrough & Korf (1967). Apothecia are convex, being about 1—2 mm diameter and orange coloured. The asci are unitunicate, operculate, cylindric to sub-cylindric and are slightly blued by Melzer's reagent. The ascospores are uniseriate, but the specimens recorded in this paper have consistently smaller ascospores being $8.5\text{--}10.5\mu\text{m} \times 16.5\text{--}18.5\mu\text{m}$.

Although cultural studies have already been performed by Gamundi & Ranalli (1964), multi-ascospored cultures were grown on potato dextrose agar and dung extract agar. They did not yield the typical *Oedocephalum* imperfect state.

From Europe and North America, it has been reported on various substrata, including dung, but these specimens were seen growing on ostrich dung only.

Sordaria humana (Fuckel) Winter Abhandl. d. Naturf. Ges. Halle 13:24, 1873. C. Moreau, 1953. *Les genres Sordaria et Pleurage*. Paris: Encyclopédie Mycologique 25:330 pp.

This species is mainly found on human ordure (Ellis & Everhart, 1892), but it has been recorded on animal dung (Dennis 1960). Specimens were growing on Angora goat dung and a few perithecia were seen on ostrich dung. They fit the description of Dennis (1960) except that the ascospores appear to be smaller being $11.4\text{--}13.0\mu\text{m} \times 17.1\text{--}21.4\mu\text{m}$.

Chaetomium sp. nov.

The perithecia have unbranched terminal hairs and the ascospores are globose and weakly beaked. It agrees most closely with *Chaetomium bostrychodes* Zopf, but this is a variable species in which the hairs may or may not be branched. Cultures have been grown on dung extract agar and one has been deposited in the Commonwealth Mycological Institute collection (IMI 145973). Cultural characteristics and development of perithecia are being investigated and these will be described in a subsequent paper.

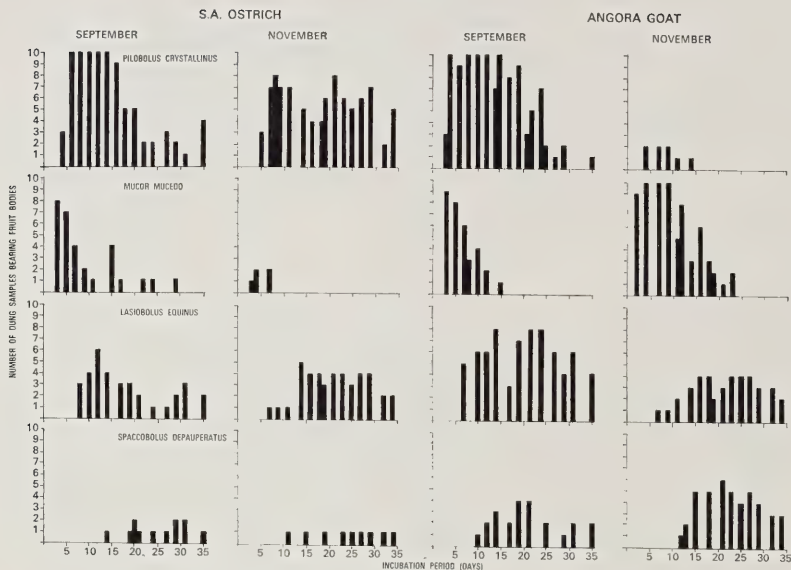


FIG. 1.

Frequency of fruiting of *Pilobolus crystallinus*, *Mucor mucedo*, *Lasiobolus equinus* and *Saccobolus depauperatus* on dung samples of S.A. ostrich and Angora goat collected during September and November, 1969.

DIRECT OBSERVATION ON COLONIZATION OF DUNG

The frequency of fruiting of phycomycetes, ascomycetes and basidiomycetes are expressed as histograms in Figs. 1—5. In the primary phase, *Mucor mucedo* (Linn.) Brefeld was the first to fruit after 2—3 days incubation and this was accompanied by sporangia of *Pilobolus crystallinus* Tode. In samples of ostrich dung collected during September and November, *P. crystallinus* persisted throughout the incubation period but although it was not possible to express this quantitatively, there was an observed decline in numbers of sporangia after 12 days incubation. In samples of Angora goat dung collected during September there was a considerable reduction in observed colonization by sporangia of *P. crystallinus* after 20 days incubation. Only two samples of Angora goat dung collected during November showed signs of colonization by *P. crystallinus*, but here, during the early stages of incubation all the samples were completely covered by mycelia and sporangia of *M. mucedo*.

Of the ascomycetes, apothecia of *Lasiobolus equinus* (Mull) Karst were the first to appear after 7 days incubation. Other discomycetes such as *Saccobolus*

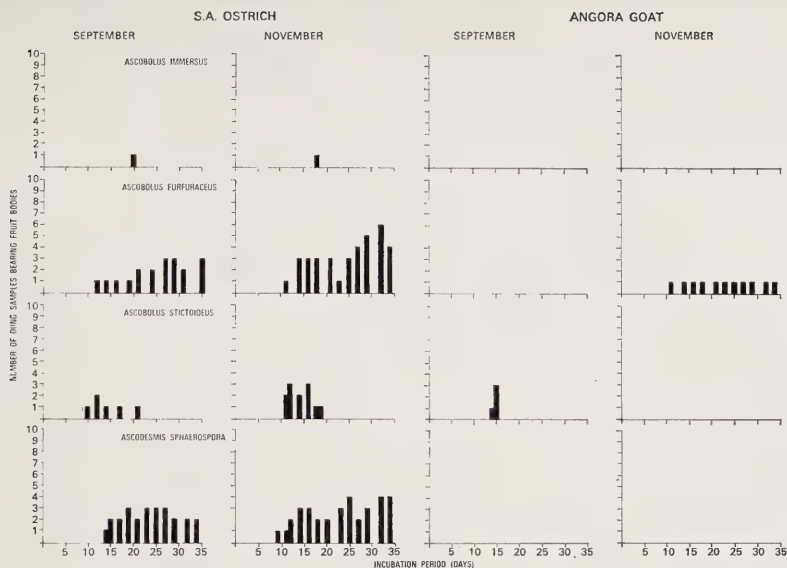


FIG. 2.

Frequency of fruiting of *Ascobolus immersus*, *Ascobolus furfuraceus*, *Ascobolus stictoides* and *Ascodesmis sphaerospora* on dung samples of S.A. ostrich and Angora goat collected during September and November, 1969.

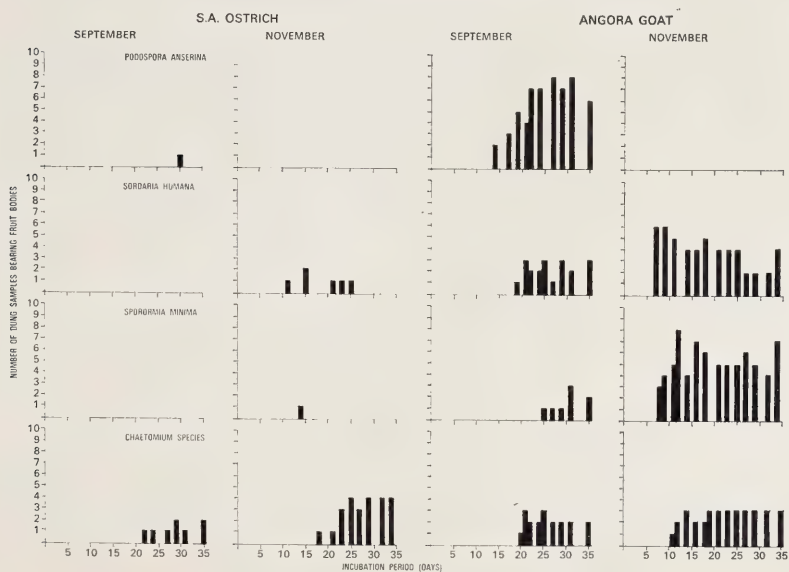


FIG. 3.

Frequency of fruiting of *Podospora anserina*, *Sordaria humana*, *Sporormia minima* and *Chaetoniium species* on dung samples of S.A. ostrich and Angora goat collected during September and November, 1969.

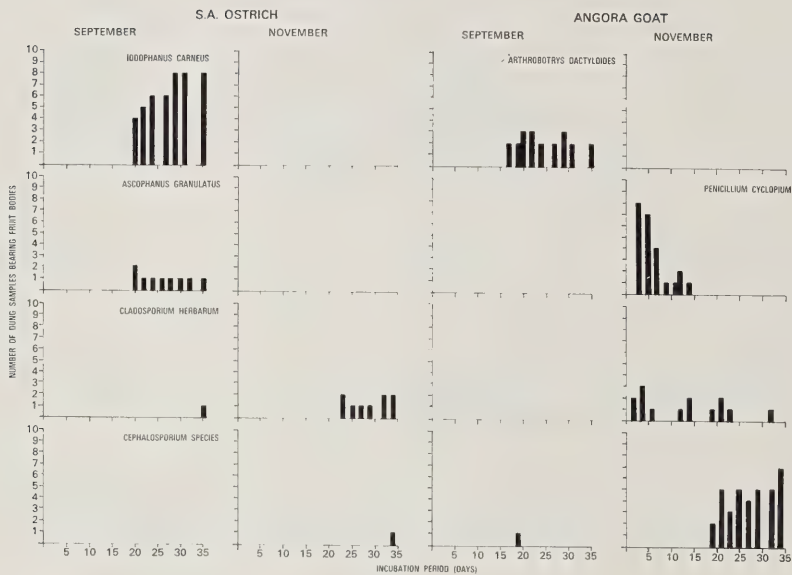


FIG. 4.

Frequency of fruiting of *Iodophanus carneus*, *Ascophanus granulatus*, *Cladosporium herbarum*, *Cephalosporium species*, *Arthrobotrys dactyloides* and *Penicillium cyclopium* on dung samples of S.A. ostrich and Angora goat collected during September and November, 1969.

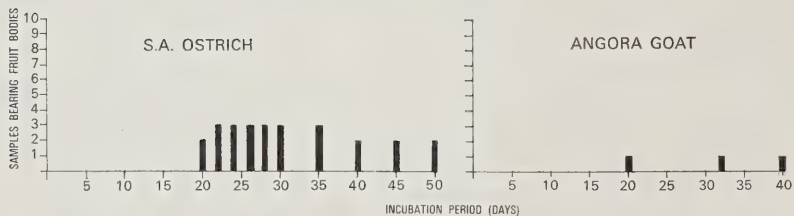


FIG. 5.

Frequency of fruiting of *Coprinus stercorarius* on dung samples of S.A. ostrich and Angora goat collected during September, 1969.

depauperatus (Berk & Broome) E. C. Hansen, *Ascobolus immersus* Pers. per Pers., *Ascobolus furfuraceus* Pers. per Hook, *Iodophanus carneus* and *Ascodesmis sphaerospora* were seen. Of these, *Saccobolus depauperatus* seemed to be the most frequent colonizing both ostrich and Angora goat dung. The other species were mainly isolated from ostrich dung but the November samples showed a general reduction in apothecial development with a complete absence of apothecia of *I. carneus*. There was, however, very little colonization by coprophilous pyrenomycetes on ostrich dung. *Podospora anserina* (Cesati) Niessl., *Sordaria humana*, *Sporormia minima* Auerswald and a *Chaetomium* species were identified on Angora goat dung. Time of sporulation varied but *Chaetomium* sp. was last to produce perithecia.

One basidiomycete was recorded. This was *Coprinus stercorearius* (Scop. ex Fr.) Fr. which fruited late in the fungus succession after 20 days incubation in those samples collected during September. The infrequency of basidiomycetes may account for the persistence of the phycomycete phase and ascomycete fruit bodies in many of the samples (Harper & Webster, 1964).

Times of sporulation of *Cladosporium herbarum* Link and *Cephalosporium* species are recorded in the histograms (Fig. 4). *Penicillium cyclopium* Westling has been isolated in the S.W. Cape (Doidge, 1945) but it is recorded on dung for the first time and is most likely an aerial contaminant.

DISCUSSION

In general, the observations on dung samples confirm the well known succession of fruit bodies. The initial phycomycete phase was recorded which appears to contradict earlier observations on samples collected in southern Africa (Gibbs, 1909). The succession was observed within 35 days incubation but it has been stressed that this phenomenon is slower under field conditions than in the laboratory (Harper & Webster, 1964). However, samples were collected on two occasions, the first during a relatively moist month (September, 1969) and the other during a dry month (November, 1969). In the laboratory under optimum conditions, there was an observed reduction of fruit bodies including a complete absence of the basidiomycete phase in those samples collected during November. A majority of the November samples were colonized by *C. herbarum* and *Cephalosporium* species.

On ostrich dung there was a predominance of discomycetes whereas on Angora goat dung the coprophilous pyrenomycetes were more important. This variation poses an ecological question on the growth of these fungi. Further investigations will have to be carried out, but one possibility is proposed. It may be nutritional in that the fungi are growing on two substrates of different composition.

ACKNOWLEDGEMENTS

I am very grateful to the Directors of the Royal Botanical Gardens and Commonwealth Mycological Institute, Kew, for examining and commenting on *Iodophanus carneus* and *Chaetomium species* respectively.

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